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ABSTRACT

Two contrasting theories of reading are reviewed in light of recent research in psycholinguistics. A strictly "visual" model of fluent reading is contrasted with several mediational theories where auditory or articulatory coding is deemed necessary for comprehension. Surveying the research in visual information processing, oral reading, subvocalization, and reading speed, the author concludes that the "visual" hypothesis is not commensurate with these findings. In particular, an experiment predicting the pause structure in fluent reading is reported, and a level of understanding involving both deep and surface structure information is proposed as characterizing such performances. Implications for beginning reading are drawn. (Author/MS)

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LEVELS OF SYNTACTIC REALIZATION IN ORAL READING

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National Reading Conference,
Tampa, 1971

I am here today to talk about two different perspectives in reading theory and research. The first I would characterize as the "visual" approach to the problem, where it is hypothesized that the fluent reader is able to go from the visual processing of letter configurations or features directly to some type of semantic interpretation, bypassing any need for auditory or articulatory mediation (Kolers, 1970; Smith, 1970). The second approach hypothesizes an additional step in this process, involving auditory rehearsal (Sperling, 1970), articulatory referencing (Hochberg, 1970), or abstract distinctive feature representations of lexical items (Chomsky, 1970; Brown, 1970). The former point of view is presently gaining much favor in professional reading groups, and before the issue is completely closed, I thought it might be profitable to review some of the evidence that bears on this question; especially since the reading texts and systems are already in press proclaiming this as the psycholinguistic theory of reading.

Let me say from the start that I know of no evidence that would suggest that it is possible to have a strictly visual representation of language, at any level. In fact the evidence is directly contrary.

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we do not know how we communicate by language, but it would appear that the auditory system is especially adapted to the rapid, sequential information-processing we call understanding language (Liberman, 1967; Lenneberg, 1967). The eye does not have the same temporal capacity for language as does the ear. Readout from very-short-term visual memory is relatively slow (Sperling, 1970), and even in visual-perception-to-writing tasks some type of auditory rehearsal component must be incorporated to account for what is retained. Unlike the earlier tachistoscopic studies, the study of sequential language displays suggests that visual masking and interference are factors in accounting for the slow, 3-4 item per second rate we find. We know, for example, that it is impossible to "read" any form of visible speech (such as spectogram) when held for continuous inspection, much less at real-time speeds.

We also know that in predicting letter reversal errors in early oral reading, differences in one phonetic feature are most important than problems in scanning. Liberman (1971) reports that in letter orientation confusions of the letters b, d, and p; b is most frequently mistaken for one of the other two consonants; perhaps because it allows the reader two chances to make an error by a single phonetic feature (place and voicing). It is also interesting to observe that there is no demonstrated relationship between visual perception and reading ability. For that matter, there is no evidence that one can train or improve visual perception itself, much less claim that it might be important in reading. On the contrary, some type of periph-

eral motor feedback or referencing appears to be more directly related to the central process.

The evidence on implicit speech or subvocalization in silent reading will not go away. It is embarrassing to all of us who favor a more cognitive view of reading, but I believe we are obligated to explain the phenomenon. The facts are that EMG recordings indicate tonic and phasic activity in the articulatory musculature during all silent reading (Edfeldt, 1960; McGuigan, 1970); that increasing reading difficulty is correlated with increases in this activity; that interfering with subvocal activity produces marked decrements in silent reading comprehension (Hardyck and Petrinovich, 1970); and that in general, subvocalization appears to facilitate reading comprehension. Various explanations have been offered for this correlated phenomenon, but all of them must account for the fact that articulatory referencing, even when no auditory signal is produced, facilitates the comprehension of language. The very interesting success of Rozin, Poritsky, and Sotsky (1971) in teaching Chinese ideographs to second graders with reading difficulties led them to propose not a whole-word or other visual approach to reading methodology, but instead, a return to Bloomfield's syllable as a suitable unit of instruction midway between the phonetic basis of English orthography and the morphemic character of the language. For despite what Smith (1971) and others of the visual processing persuasion have said about the lack of spelling-sound relationships in

English, the orthography is not only essentially phonetic, but perhaps ideally so.

Chomsky and Halle in their major theoretical work on the phonological rules of English, The Sound Pattern of English (1968), have contended that an acceptable oral rendering of a passage requires greater linguistic sophistication, more fully involving the reading process, than was previously thought to be the case. They observe that "conventional orthography, being close to the linguistically significant system underlying ordinary speech, can be read only when the surface structure (including the internal structure of words) is known, that is, when the utterance is to some degree understood." This is again in counterdistinction to the visual processing hypothesis which contends that oral reading is irrelevant because it is possible to read alound without comprehension, and that oral reading is grossly inefficient.

In an experiment reported more fully elsewhere (Brown and Miron, 1971), I have attempted to explore this hypothesis by establishing that a proficient oral reader demonstrates his grammatical comprehension of a passage by the occurrence and duration of his pausing. This study specifically investigated the predictability of pause time in a 1537 word spoken message. The performance of a professional reader paced at 164 wpm was analyzed from three points of view. The first slide demonstrates the three grammatical analyses of text. An IC, or Immediate Constituent, analysis was performed

on each of the 84 sentences in the message. A simple IC boundary depth measure was calculated between each successive pair of words, counting all left and right facing brackets at that juncture. This measure would generally reflect surface structure complexity. A second measure (SCI) provided a slight variation on this procedure, following Chomsky and Miller's (1963) suggestion of a node-to-terminal-node ratio in the tree diagram of the terminal string. The third measure attempted to specify corresponding deep structure breaks in the surface structure. These deep structure analogues (DSA) generally coincided with clauses, however, additional specifications of other conjoining transformations were noted as well. This analysis was thought to account for deep structural breaks that might not occur in a surface structure analysis alone. An oscillographic recording of the entire message was performed, and text then appended so that all pauses could be related to morphemic analysis.

These three syntactic variables plus several additional lexical measures were entered into a multiple regression equation for the prediction of pause time. The final multiple $\underline{R}$ was .80, accounting for 64% of the pause time variance. The second slide shows the various contributions of each of the predictor variables. As can be seen, IC accounted for more than 55% of the variance; DSA brought the R^2 figure to 61%; while SCI added an additional 2%. The important fact to draw from this display is that both IC and DSA are substantial predictors of Pause, and although they share a con-

siderable proportion of variance (as would be expected from their theoretical assumptions), nonetheless each variable makes an additional unique contribution, preserving the grammatical distinction between observed and deep structure. It would appear that from a diagnostic point of view an "acceptable" oral reading performance indicated an understanding of both deep and surface structure configurations in the material read.

This level of understanding that is necessary for oral reading can be made quite precise. It does not mean that the message in its fullest sense is understood; there is too much evidence from oral reading problems to the contrary. However, it does mean that all grammatical relations are comprehended including the grammatical categories of words (Kolers, 1970), and that the internal structure of the words themselves is well understood. (If we follow Chomsky, word meanings are undoubtedly a part of this understanding.) What is left is the psychological process of understanding language regardless of modality, a process undoubtedly made up of large components of context, set, and attention. Nonetheless, it is at this level of processing the I have defined reading as a completed act.

The final issue I wish to raise is the problem of efficiency in reading. One of the major sources of evidence for the visual hypothesis is explaining the performance of rapid readers. Obviously someone reading at two to three thousand words per minute cannot be functioning at the speed of speech. Therefore she must be en-

gaged in some more direct type of processing. Unfortunately, it is not clear that such reading is possible or has indeed ever taken place. We lack any systematic, well-controlled documentation of such performances, and the associated problems in measurement make prospects dim for such a study taking place in the near future. Moreover the work in time-compressed speech suggests that there is likely to be a uniform language processing speed, regardless of modality. I am inclined to believe that our understanding of language and reading proceeds more or less at the rate our thinking about what we read or hear, which is the rate of implicit or explicit speech.

Certainly it seems premature to deemphasize the attention given to words and syllables in early reading, as is proposed in recent promotional literature for textbook concerns under the title of a psycholinguistic approach to reading. No one denies that semantic expectation and reduction of uncertainty are important strategies in successful reading. Neither is it unreasonable to encourage the largest manageable unit in the decoding process. But this assumes an automatization of function in reading that is not initially present. A skilled reader does most of his perception through the contextual constraints of language; but how does the child get there without principled reading acquisition instruction. To point to skilled readers as the model may be misleading. The fact that some children learn to read on their own without any systematic

introduction to the process is interesting, but it is unrealistic to assume that all children might learn in this fashion. In Dolores Durkin's (1966) study of the spontaneous onset of early reading, she found that this ability was unrelated to intelligence within the normal to superior range and could occur in all social classes. Just as we used to have the radio phenomenon of individuals who could do complex arithmetic operations in their heads --carrying out long multiplications without mnemonic aid--this does not mean that we should have all children aspiring after this ability using the same self-taught procedures.

In summary, I find no substantive evidence to suggest that a visual hypothesis in reading has any particular adequacy in explaining the available evidence. Surveying the research in visual information processing, oral reading, subvocalization, and reading speed, I find nothing to suggest that this theory is even commensurate with these findings. I hope that those involved with reading education will not "converge" prematurely on a theory of reading and reading instruction. I happen to believe that children need some systematic instruction in decoding print to oral language. To paraphrase Caleb Gattegno's recent assertion in the Harvard Educational Review, "The problem of reading is (not) solved."

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